A Microcomputer Assessment System (MAS) for administering computer-based surveys: Preliminary results from administration to clients at an impaired-driver treatment program

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The Microcomputer Assessment System (MAS), written in C language, allows a researcher to design and administer computer-based surveys by manipulating ASCII text files and requires no knowledge of a traditional programming language. The system was designed to provide maximum user flexibility: MAS allows both multiple-choice and open-ended (fill-in) questions and allows control over text color, allowable answers, and summary output. MAS also assesses response latency and includes support for random assignment of different instruments to respondents. MAS runs under MS-DOS 3.0 or higher, requires 640K of RAM, a color screen (EGA or better), and an extended keyboard. Preliminary results from an application of MAS to a sample of 121 clients at an impaired-driver treatment program are summarized.

Self-reports of alcohol use have widespread application in impaired-driver treatment programs because other satisfactory and practical measures are generally unavailable (cf. Sobell, Maisto, Sobell, & Cooper, 1979; Williams, Aitken, & Malin, 1985). Alcohol-use self-reports may be influenced by the nature of response options offered (Hesselbrock, Babor, Hesselbrock, Meyer, & Workman, 1983; Poikolainen & Karkkainen, 1985), the nature of the setting in which they are given (Gfroerer, 1985), and whether reports are about use of alcohol in specific settings or generic use (Hilton, 1986). Babor, Stephens, and Marlatt (1987, p. 420) concluded that "alcohol research would benefit from a new generation of methodological research directed at procedures that enhance the validity of verbal report data. . . . The use of computerized assessments may yield more valid data . . . than other techniques." Clearly, there is a need to examine alternatives to traditional paper-and-pencil surveys that will minimize errors of measurement of alcohol use (Allen & Skinner, 1987; Skinner & Allen, 1983).

We have developed a data-collection program that allows a researcher to design and administer computer-

based surveys by manipulating ASCII text files and that requires no knowledge of a traditional programming language. This paper summarizes the development of the program and preliminary results of its use in a pilot sample of 121 clients at a treatment program for persons convicted of impaired driving.

FEATURES OF MICROCOMPUTER ASSESSMENT SYSTEM

Because of the flux in the state of the art of microcomputer programs for survey administration and our desire to tailor a program to our specifications and ensure quality control, we decided to develop a new data-collection program, the Microcomputer Assessment System (MAS). Our key data-collection requirements included administrator- and respondent-friendliness, portability, long-distance manageability, stand-alone system, randomization of administered items to different respondents, and capacity to accommodate a lengthy survey battery. MAS was designed to provide maximum user flexibility: it allows both multiple-choice and open-ended (fill-in) questions and allows control over text color, allowable answers, and summary output. MAS also assesses response latency (i.e., time to response for each item).

MAS is written in C language (Borland C++ compiler) and runs under MS-DOS 3.0 or higher, requires 640K of RAM, a color screen (EGA or better), and an extended keyboard. Questions and response options are presented in the default font, 25 lines of 80 characters, using

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Table 1
Special Characters Used in Instructions and Item Input Files

Characters	Description
#	Comment—used for putting a blank line in a question
<blank>	Blank line separates questions from answers
*	Terminate a question
**	Terminate a question with multiple answers allowed
*!	Terminate an optional question
**!	Terminate an optional question with multiple answers allowed
\$ text	Terminate a question that will be summarized; title is "text"
\$\$ text	Terminate a summarized question with multiple answers
\$! text	Terminate an optional summarized question
\$\$! text	Terminate an optional summarized question with multiple answers
digit	1-9 to indicate the value assigned to this answer for scoring

Other special characters:

= (2-10)	Fill-in answer with allowed values from 2 to 10, for example
\ =	Used to hide an "=" from the fill-in hack so = can be in question

Table 2
Example Input for Multiple-Choice Item

MICROCOMPUTER ASSESSMENT SYSTEM	
#	What day is it?
	MONDAY
	TUESDAY
	WEDNESDAY
	THURSDAY
	FRIDAY
	SATURDAY
	SUNDAY
*	

Table 3
Screen Display for Multiple-Choice Item

MICROCOMPUTER ASSESSMENT SYSTEM	
	What day is it?
	MONDAY
	TUESDAY
	WEDNESDAY
	THURSDAY
	FRIDAY
	SATURDAY
	SUNDAY
Use up and down arrows to point, and SPACE to select.	
Left and right arrows to go forward and back, ENTER to proceed.	

administrator-selected color cues to distinguish among the question, the selected response, unselected response options, and instructions.

Program Interface

The program interface was derived through an evaluation of existing programs and a series of brainstorming meetings among project staff. MAS was designed to allow self-administration of surveys by computer with minimal outside assistance. The program relies on the use of a limited number of keys: the software ignores keystrokes for the remaining keys. Color is used to initially distinguish response choices from item stems, and when a response is selected, the color is changed to match the item stem.

Input Elements

Instructions and items. Instructions to respondents and questionnaire items are read by MAS from ASCII files created by the administrator. A simple set of special characters embedded in the ASCII files is used to communicate that a question can have multiple responses, has

a write-in response, is optional, or is to be included in the output summary, and to indicate where blank lines of text should be displayed (see Table 1). An example of an input file for a multiple-choice item is provided in Table 2. The file consists primarily of text that will be presented verbatim to the respondent with one pound (waffle, octothorp, number sign, splat) character denoting the placement of a blank line. This type of item is terminated with a single asterisk. The screen display associated with this input file is provided in Table 3.

An example of the input for an item with multiple answers allowed is given in Table 4. Again, the file consists primarily of text that will be presented verbatim to the respondent with one pound character denoting the placement of a blank line. In addition, the column of numbers in the left corner informs MAS about the weights to use in calculating a summary score for this question (i.e., unit weighted except for zero weight for a response of "None of the Above"). This type of item is terminated with double asterisks. The screen display associated with this input file is provided in Table 5.

Table 4
Example Input for Item with Multiple Responses Allowed

MICROCOMPUTER ASSESSMENT SYSTEM	
#	Which of the following statements are TRUE of you? (Please select all that apply)
1	I DRINK TO CALM MY NERVES.
1	I FEEL LIKE CONTINUING TO DRINK WHEN OTHERS HAVE STOPPED.
1	I FEEL UNCOMFORTABLE IN SITUATIONS WHEN ALCOHOL IS NOT AVAILABLE.
1	I DRINK ALCOHOL TO GET RELIEF.
1	I HAVE MEMORY LAPSES AFTER DRINKING.
1	I THINK ABOUT OR LOOK FORWARD TO THE TIMES WHEN I CAN DRINK ALCOHOL.
1	I GET IRRITATED WHEN MY DRINKING IS DISCUSSED BY OTHERS.
1	MY TOLERANCE TO ALCOHOL HAS INCREASED.
0	NONE OF THE ABOVE
**	

Table 5
Screen Display for Item with Multiple Responses Allowed

MICROCOMPUTER ASSESSMENT SYSTEM	
Which of the following statements are TRUE of you? (Please select all that apply)	
I DRINK TO CALM MY NERVES.	
I FEEL LIKE CONTINUING TO DRINK WHEN OTHERS HAVE STOPPED.	
I FEEL UNCOMFORTABLE IN SITUATIONS WHEN ALCOHOL IS NOT AVAILABLE.	
I DRINK ALCOHOL TO GET RELIEF.	
I HAVE MEMORY LAPSES AFTER DRINKING.	
I THINK ABOUT OR LOOK FORWARD TO THE TIMES WHEN I CAN DRINK ALCOHOL.	
I GET IRRITATED WHEN MY DRINKING IS DISCUSSED BY OTHERS.	
MY TOLERANCE TO ALCOHOL HAS INCREASED.	
NONE OF THE ABOVE	
Use up and down arrows to point, and SPACE to select. Left and right arrows to go forward and back, ENTER to proceed.	

Table 6
Example Input for Open-Ended (Fill-In) Item

MICROCOMPUTER ASSESSMENT SYSTEM

#

#

#

#

How old were you on your last birthday?

AGE: = (1-99)

*

Table 7
Screen Display for Open-Ended (Fill-In) Item

MICROCOMPUTER ASSESSMENT SYSTEM

How old were you on your last birthday?

AGE:

Please enter a number from 1 to 99.

Left and right arrows to go forward and back, ENTER to proceed.

Table 8
Example General Configuration File

Test directory: pilot

Print summary: no

The following number is added to the sequence number for reporting.

ID offset: 1000

Randomization: rfile

Sequence file: sequence

Report name: reports

Summary file: summary

Color selection section

Legal background colors are:

BLACK, BLUE, GREEN, CYAN, RED, MAGENTA, BROWN, and LIGHTGRAY

Legal foreground colors include those and:

DARKGRAY, LIGHTBLUE, LIGHTGREEN, LIGHTCYAN, LIGHTRED, LIGHTMAGENTA,

YELLOW, and WHITE.

Questioncolor: LIGHTCYAN

Highlightfore: LIGHTCYAN

Highlightback: WHITE

Normalback: BLACK

Normalfore: LIGHTGRAY

Selectedfore: LIGHTCYAN

Selectedback: BLACK

Divider: LIGHTRED

Instructionfore: LIGHTGRAY

Instructionback: BLACK

Several different feeps are available:

0 - 880 hz feep

1 - 440 hz feep

2 - octave swoop

3 - faster swoop

4 - gurgle

5 - scale

6 - Buckaroo Banzai theme (opening notes)

Any other number - no noise

Feep: 7

Table 9
Example Specific Configuration File

Test:	pilot.ins	INSTRUCTIONS
Start timer:		
Test:	pilot.ron	READING ASSESSMENT
Test:	pilot.han	HANG OF IT
Test:	pilot.bac	BACKGROUND
Test:	pilot.sdr	SDRS
Test:	pilot.lif	LIFE EVENTS
Test:	pilot.flu	FREQUENCY OF ALCOHOL USE
Test:	pilot.per	YOUR PERCEPTIONS
Test:	pilot.in2	SELECT ALL THAT APPLY INSTRUCTIONS
Test:	pilot.jel	JELLINEK
Test:	pilot.cag	CAGE
Test:	pilot.driv	DRIVING-RELATED
Test:	pilot.dru	DRUG USE
Test:	pilot.qua	QUANTITY OF ALCOHOL USE
Test:	pilot.you	HALFWAY
Test:	pilot.res	RESPONSIVENESS TO AA
Test:	pilot.aud	AUDIT
Test:	pilot.med	MEDICATION USE
Test:	pilot.dpr	DRINKING IS A PROBLEM
Test:	pilot.mas	MAST
Test:	pilot.und	UNDER THE INFLUENCE
Stop timer:		
Test:	pilot.com	COMPUTER ANXIETY
Test:	pilot.end	END

An example of the input for an open-ended (fill-in) item is given in Table 6. A pound character is used four times in this example to insert four blank lines. The fill-in nature of the item is communicated by using a bracketed numeric range. This type of item is terminated with a single asterisk. The screen display associated with this input file is provided in Table 7.

Configuration files. MAS accesses two types of configuration files: general and specific. The general configuration file indicates where the items to be administered are stored, the names of general input and output files, the display color, and the sound "feep" to use following each response (see Table 8). MAS tracks the sequential number of each respondent. This number is used as an index into a file of randomly ordered numbers to select a specific configuration file that determines which instruments to administer and in what order to administer them.

The specific configuration files are linked to the randomization option of MAS so that each file represents a different assigned condition. These files communicate which questions to administer to respondents assigned to the condition and the order of administration. In addition, placement of two special commands (start and stop timer) is used to designate a block of the interview whose time of administration will be summarized in the output files (see Table 9).

Output Elements

MAS saves an ASCII output file that contains the responses to each item and response times (see Table 10). In the pilot study (see below), these raw data are sent from the data-collection site to RAND by modem using the

UUPC file-transfer package and are then translated to a standard analytic raw-data format using a PERL program we designed. Data are then analyzed using standard software packages (e.g., SAS). MAS also prints out a one-page feedback sheet that summarizes responses given by the respondent. Example output is given in Table 11.

PILOT STUDY OF MAS

Method

Subjects. One hundred and twenty-one clients (91 males, 20 females) at a West Coast treatment center for impaired drivers were sampled. The center was chosen because its clients are representative of the driving-under-the-influence (DUI) offenders required by the courts to attend treatment programs in the Los Angeles area.

The average age of the respondents was 33 years, with a range from 20 to 75. Eighty-eight percent of the sample were non-Hispanic white, 88% were high-school graduates, and 26% were married and living with their spouses. Yearly household income was below \$30,000 for 51% of the sample.

The respondents reported an average of 1.6 convictions in the last 7 years for driving under the influence and an average blood alcohol concentration of 0.16 at the time of the last arrest, and 21% reported one or more automobile accidents during the last 12 months. In the sample, 26% categorized themselves as alcoholic, 15% as problem drinkers, 39% as social drinkers, and 12% as light drinkers, and 7% reported drinking only on special occasions.

Measures. One hundred and twenty-five questions were posed to participants in the pilot study. Included in the

Table 10
Example Raw Data Output

Person 200 assigned to group 2.
Time: Fri Nov 15 09:31:16 1991
Test: INSTRUCTIONS
1 4.9
2 1.3
3 0.8
4 1.4
MONDAY
5 1.6
YES
6 0.6
Test: READING ASSESSMENT
1 0.7
2 1.6
a. Barbara
3 0.8
a. 16 dollars
4 0.7
a. Lucky's
Test: HANG OF IT
1 0.6
...
Test: COMPUTER ANXIETY
1 1.2
2 1.2
DEFINITELY TRUE
3 0.8
DEFINITELY TRUE
4 0.7
DEFINITELY TRUE
5 0.7
DEFINITELY TRUE
6 0.7
NONE OF THEM
7 0.7
A LOT EASIER
8 0.8
MUCH TOO SHORT
Test: END
1 0.7
Total time for the interview: 68 seconds.

battery were the CAGE (Mayfield, McLeod, & Hall, 1974), a revised version of the AUDIT (Babor & Grant, 1989), the short form of the MAST (Selzer, Vinokur, & Van Rooijan, 1975), and a short-form measure of socially desirable response set (Hays, Hayashi, & Stewart, 1989).

A short reading assessment, sociodemographic items, life events, drug use, and several additional questions about alcohol use were also included. The order of administering the frequency of alcohol-use items within the interview and the nature of response options for these items were randomized to respondents.

Results

Average time to complete the 125-item questionnaire was 32 min ($SD = 11$, range of 16–76 min). Internal-consistency reliability estimates (Cronbach, 1951) for the five multi-item measures included in the study were .60 or higher: short-MAST (.85), AUDIT (.85), CAGE (.64),

SDRS-5 (.61), and computer anxiety (.72). These reliabilities are comparable to those reported in previous studies for identical or similar measures when administered by paper and pencil (Hays et al., 1989; Meier & Lambert, 1991; Selzer et al., 1975; Zung, 1979), although the estimated internal-consistency reliability of the CAGE was notably higher in a previous study (Fleming & Barry, 1991).

Reaction of respondents to the computer interview was generally very favorable. The majority of the respondents indicated that they did not feel uneasy (82%), tense (87%), or nervous (90%) using the computer. In addition, most respondents had no problems using the computer (59% responded "definitely true" and 19% "mostly true"). Eighty-one percent of the clients said they answered all of the questions in the interview honestly, and the remainder reported answering most of them honestly. In comparison to answering the questions by a counselor,

Table 11
Example Feedback Sheet

Microcomputer Client Information Sheet	
Time: Tue Jul 16 16:49:54 1991	
Person 3 assigned to group 5.	
AGE:	22
GENDER:	MALE
RACE:	WHITE
MARITAL STATUS:	MARRIED AND LIVING WITH SPOUSE (OR SIGNIFICANT OTHER)
EDUCATION:	SOME HIGH SCHOOL OR LESS
INCOME:	4,999 DOLLARS OR LESS
N OF PEOPLE INCOME SUPPORTS:	ONE
LANGUAGE SPOKEN:	ENGLISH
PROGRAM BEGINNING:	FIRST OFFENDER PROGRAM (3 MONTHS)
DAYS OF LAST WEEK ALCOHOL USE:	5 DAYS
DRINKING NOW IS:	MUCH MORE OFTEN NOW THAN BEFORE
TREATMENT GOAL:	NEVER DRINKING IS NOT NECESSARY FOR ME, AND I
TREATMENT GOAL:	SEE NO NEED TO REDUCE MY DRINKING.
ALCOHOLISM IS:	DISEASE
CLIENT IS:	ALCOHOLIC
FEET:	5
INCHES:	5
WEIGHT:	123
BAC:	23
INTOXICATION DURING DUI:	EXTREMELY INTOXICATED
TAKE CRITICISM WELL:	NO
MEDICATION USE LAST 6 MONTHS:	NO
HISTORY OF COUNSELING:	ALCOHOL OR DRUG USE
DRINKING IS A PROBLEM NOW:	ALL OF THE TIME
LONGEST TIME SOBER LAST YEAR:	LESS THAN A DAY
WANTED/COULDN'T STOP DRINKING:	NO
EVER NEED A MORNING DRINK:	NO
EVER ATTENDED AA:	NO
DRINKS OF ALCOHOL TODAY:	NONE
NONPRESCRIBED DRUG USE TODAY:	NO
AGREES TO RAND STUDY:	YES
BACKGROUND total:	0
SOC. DESIRABLE RESPONSE total:	2
LIFE EVENTS total:	0
JELLINEK 1:	1
JELLINEK 2:	1
JELLINEK 3:	1
JELLINEK total:	3
CAGE total:	3
AUDIT total:	20
MAST total:	9

31% of the respondents indicated that the computer interview was "a lot easier," 12% indicated "a little easier," 50% reported "about the same," 7% reported "a little harder," and 1% indicated "a lot harder."

Summary of Pilot Study

The preliminary results of the pilot study suggest that MAS is a feasible methodology for collecting intake data at DUI treatment programs. Moreover, respondents tend to provide internally consistent data and to have very few problems with the microcomputer interview. Future analyses will examine methodological effects of varying the nature and placement of frequency-of-alcohol-use response choices within the interview.

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